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We Did It!

ERADICATING HOG CHOLERA from the United States is more than just another government program—it's a remarkable scientific and technical achievement. It happened only because of a massive Federal-State-farmer-industry cooperative effort.

We have wiped out the most costly and deadly swine disease the United States ever had. The impact on animal health can be compared with eliminating polio in humans. And, this is one government program that has started—and finished under cost.

Cost of the eradication campaign was estimated at between \$160 and \$200 million in 1962. Actual cost was \$140 million.

Hog cholera began somewhere in the newly settled Ohio River country in the early 1830's. It is a "native" U.S. disease. From this modest beginning, it spread throughout the United States and the world.

We get a lot more from pigs than just bacon, ham, sausage, and pork chops. To name a few—leather belts, gloves, jackets, shoes, and hats. Mattress and baseball glove stuffing. High-quality brush bristles. Insulin, ACTH, and other medicines. Valves from young pig hearts replace human heart valves—each year about 20,000 Americans have heart valve transplants.

Between 83 and 84 million hogs are marketed in the United States each year. Per capita consumption of pork in the last 4 years averaged 62.1 pounds, compared with 118.8 pounds of beef. A quarter of the Nation's 2.8 million farms raise hogs.

As a group, farmers profit most directly from the eradication of hog cholera. However, the gradual elimination of hog cholera since 1962 has helped keep the retail price of pork in check. Eradicating hog cholera also means that more foreign markets will open to U.S. pork—ultimately helping our balance of payments. England alone is expected to import \$10 million worth of U.S. pork this year.

The entire eradication effort, however, would not have been possible without 100 years of hog cholera research. SEA research provided the major tools for regulatory agencies to use. And, that's what agricultural research is all about.—M.M.M.

On January 24, 1978, three USDA agencies—the Agricultural Research Service (ARS), the Cooperative State Research Service (CSRS), and Extension Service (ES)—and the National Agricultural Library (NAL) were merged into a new organization, the Science and Education Administration (SEA).

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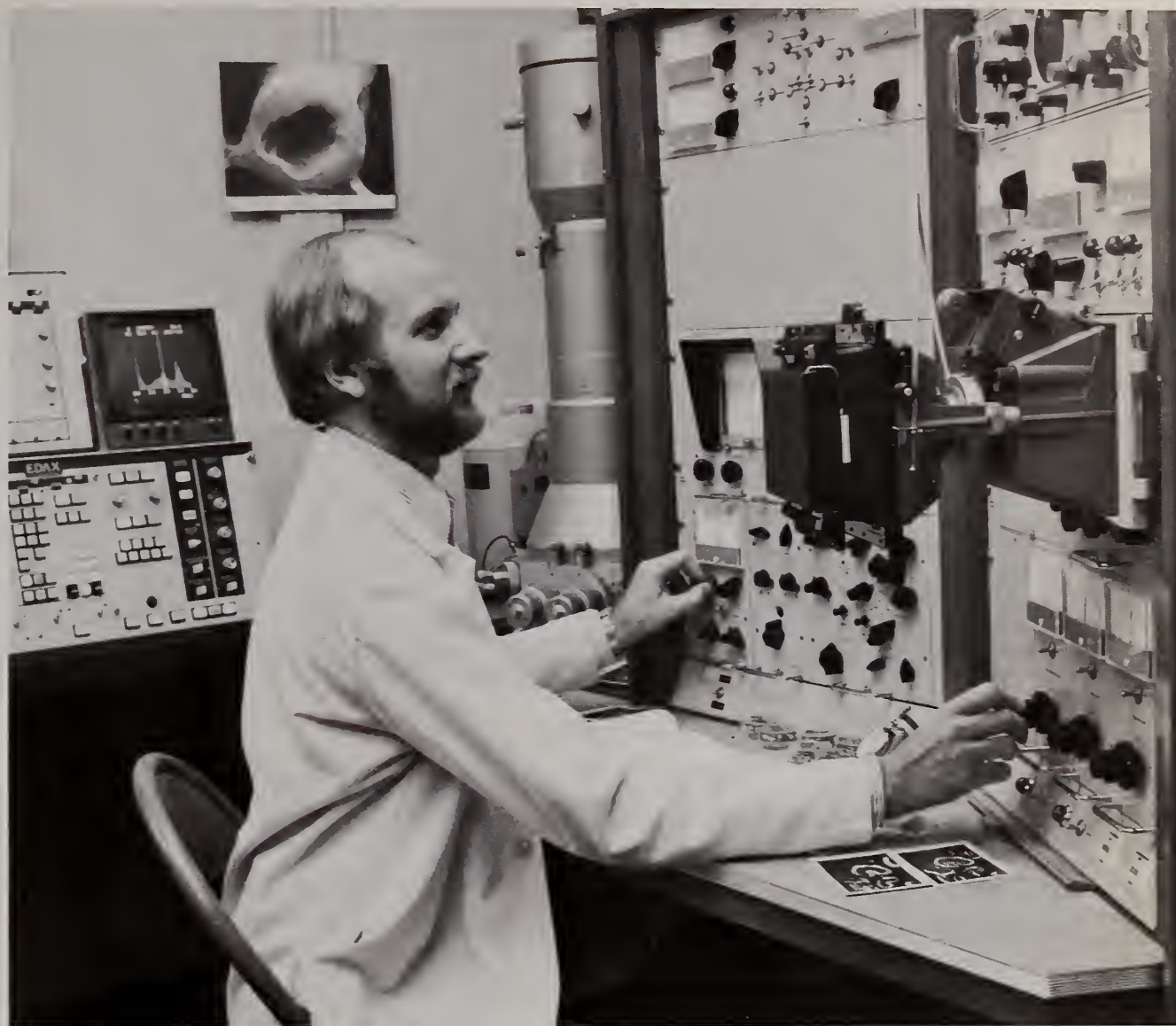
COVER: The surface of a cotton fabric treated with THPOH-Ammonia flame retardant, as photographed through an electron microscope. Photographs of images formed with scanning electron microscopy and energy-dispersive X-ray analysis have become increasingly useful in studying textile finishes (PN-4157).

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Bob Bergland, Secretary
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Mr. Wilton R. Goynes, Jr., a research chemist at the Southern Regional Research Center in New Orleans, adjusts photographic apparatus built into an electron microscope—i.e., the cylindrical column on his left. The camera to his right makes instant photographs off a phosphor screen image of the electron dispersion pattern generated by the microscope. The screens can also display X-ray dispersion patterns for the same sample. Similar electron microscopes may be equipped with an actual television monitoring system for the continuous study of moving subjects such as fibers in the process of breaking (BN-46150).



With Scanning Electron Microscopy

... Seeing is Believing

SCANNING ELECTRON MICROSCOPY (SEM) and energy-dispersive X-ray (EDX) analysis combine to form a powerful tool in research on the chemical finishing of cotton.

With them scientists can look at the cotton fibers, even into them, and actually see the results of their research. They can see what happens to the physical characteristics of the fabric and individual fibers and they can see where the treating chemicals have lodged. Together they help the scientist eliminate an element of "guesswork" or "assumption" about the results of his research.

Chemical finishes are commonly used

to improve or impart to textiles such properties as wrinkle and flame resistance or water, oil, and soil repellency.

The physical characteristics of the fibers and the location and distribution of the finishing chemicals in relation to the structural elements of the fabrics are important to both the effectiveness and the durability of the finish. However, because of the limitations of optical microscopy and transmission electron microscopy, scientists were never certain about where and how the chemicals were deposited.

SEM provides a means of directly studying samples to observe surface



Single, untreated cotton fiber (PN-4158).



Untreated cotton fibers showing washer abrasion (PN-4159).

changes resulting from the various chemical finishing agents applied to the fabric. In SEM a specimen is bombarded with an electron beam. Secondary electrons emitted from the bombarded specimen are collected to form the SEM image in a form readily perceived by the unaided eye. Unlike other forms of microscopy, SEM offers an image with remarkable resolution and depth of field so that the specimen can be studied in great detail.

At low magnifications (to about 1000X) SEM micrographs can show chemical deposits that may clog or plug up the weave of a fabric to make it

harsh or stiff or less able to "breathe."

At higher magnifications, SEM micrographs can show fascinating, almost 3-dimensional detail. For example, micrographs can show the scientist where and how chemicals are deposited on the surface of fiber, whether the deposit is thick or thin, smooth or rough, complete or patchy. SEM micrographs also show a wide variety of conditions such as abrasion damage and characteristics of fire retardant fibers after they are subjected to flame or intense heat.

Although SEM provides images of surfaces only, it can be used to study internal fiber structure. To do so, the

scientist must cut sections of fiber, yarn or fabric and examine the cut surfaces. This will expose the inside of the fiber in great depth and detail.

When EDX analysis is used to identify, in a specimen under examination, a specific element (e.g. phosphorus in a flame-retardant cotton fabric) an X-ray "map" results. When superimposed over the micrograph of the cross section, the "map" shows precisely where the element is located and how evenly or unevenly it is dispersed throughout the section; the scientist can immediately determine results of his efforts.—*V.R.B.*

Cross-section of cotton fibers treated with THPOH-Ammonia flame retardant (left, PN-4160) and EDX map of the

cross-section (right, PN-4161) showing the location of phosphorus on the cotton fibers.



New Analysis of Cottonseed

PRECISE ANALYSIS of cottonseed and cottonseed meal for oil, protein, and moisture can be achieved in as little as 3 minutes using infrared reflectance spectroscopy (IRS). Standard chemical analytical methods require as much as 24 hours.

The IRS method was developed by SEA chemists Joseph G. Simmons and Leah C. Berardi, physical science technician Charles J. Fernandez, and

chemical engineer James I. Wadsworth.

IRS can be used to furnish processors with information useful for making seed purchases, for seed storage allocations, for improved quality control during processing, and for analyzing meal products from production lines.

To gain an analysis, a small sample of the product to be analyzed must be ground to a fine powder with care taken to avoid overheating and mois-

ture loss. The powder is then packed in the sample cell and placed in the instrument for analysis by scanning in the near infrared. Results can be read directly from a digital display meter or from a tape printer.

The research was conducted at the Southern Regional Research Center, 1100 Robert E. Lee Blvd., P.O. Box 19687, New Orleans, LA 70179.—*V.R.B.*

Proso Millet... A Forgotten Grain



Millet (*Panicum miliaceum*).

MILLET, A SMALL GRAIN with many advantages, holds promise for increasing grain production on the moisture-limited Central High Plains and in providing developing countries with a more dependable protein supply for human consumption.

Millet yields 40 to 45 bushels of grain

per acre on 13 inches of water versus winter wheat's 15 to 18 bushels; millet matures in 60 to 70 days versus wheat's 10 months from planting to harvest; and it yields 1 pound of grain per 1 pound of straw versus wheat's 1 pound of grain per 1.7 pounds of straw. Millet also begins seed formation after using only 6 inches of water versus wheat's 9- to 10-inch requirement. Protein content of millet is comparable to wheat, oats, barley and rye.

With the use of pre-emergence herbicides, seeding rates can be reduced from the current 10 to 12 pounds per acre to 5 to 7 pounds, and row widths can be widened from 6 to 8 inches to 12 to 14 inches. The higher rates and narrower rows were previously recommended to shade out competing weeds.

"Under sprinkler irrigation in eastern Colorado, proso millet could be grown when water supplies are too limited for corn, alfalfa or sugar beets. This would be an ideal crop for half-circle irrigation situations where half the rotation of a center-pivot sprinkler irrigates corn, the other half millet. Corn would receive the bulk of the limited water while millet would receive

only a few inches," says ARS soil scientist Bentley W. Greb, Akron, Colo.

Supplemental nitrogen requirement for millet on good loam and silt loam soils is minimal—less than 25 pounds per acre. Wheat requires up to 60 pounds of nitrogen.

"Current varieties of millet have some disadvantages, including nonuniform grain ripening, shattering loss and stalks too short to combine. Most of these deficiencies could be corrected with a vigorous breeding program," says Greb.

Annual production of proso millet in the United States is a modest 400,000 to 500,000 acres. Most of this is used for bird seed and animal feed. Very little is consumed by humans. Developing countries in Asia and Africa use nearly all of their annual production of 25 million tons for humans.

Millet research at Akron, in cooperation with Colorado State University, will continue next year and include studies on pre-emergence herbicides.

Mr. Bentley W. Greb's address is USDA Central Great Plains Research Station, P.O. Box K, Akron, CO 80720.—*D.H.S.*

Better Forage with Formaldehyde

ANIMAL PHYSIOLOGISTS can prevent the breakdown of high quality forage protein in the rumen, the first compartment of the stomach in sheep and cattle, by treating forages with formaldehyde. This makes protein digestion possible in the abomasum (true stomach) and small intestines, where it is needed to increase animal performance.

Although forage protein is highly digested in the ruminant, it may undergo considerable degradation with loss of protein or nitrogen as it passes through the ruminoreticulum (the first and second compartments of the stomach) en route to the abomasum.

"In the first process of ruminant protein metabolism, as much as 90 percent of the forage protein is degraded in the rumen to ammonia, a nonprotein nitrogen compound," said animal physiologist Henry E. Amos at the Field Crops Research Laboratory, Russell Research Center. "The second process of protein metabolism also occurs during passage through the ruminoreticulum. In this process bacteria and protozoa use the ammonia to synthesize microbial protein. However, due to low digestibility of the forage dry matter, bacteria degrade more protein to ammonia in the first process than can be used for the synthesis of microbial protein in the second process. It's a losing game," he said.

One answer may be formaldehyde, a protein cross-linking agent, which decreases protein solubility in the rumen fluid and decreases degradation of protein. The treatment may be of particular interest to the hay-making industry.

"If we decrease degradation, we increase the quantity of protein and amino acids which reach the true stomach and intestines where they are then available for digestion and absorption," says Dr. Amos. "Our studies indicate that treating forage with 1 percent formaldehyde increases amino acids available for digestion 1½ times."

The effects of treating coastal bermudagrass (CBG) with varying levels of formaldehyde were evaluated in a series of *in vitro* (outside the living body) fermentation studies. Abomasal digesta collection and nitrogen balance studies were also conducted *in vivo*, or inside the animal.

CBG was treated with 0, 0.5, 1.0, 2.0, 4.0, 8.0, 12.0 and 16.0 percent formaldehyde. The amount of *in vitro* dry matter digested decreased with increasing concentrations of formaldehyde up to the 4 percent treatment level and then remained constant. *In vitro* ammonia release also declined up to the 4-percent level. Forage protein appeared to be completely unavailable to the rumen microorganisms at formaldehyde treatment levels of 8 percent or above.

CBG hay was treated with 0, 0.5, 1.0,

or 1.5 percent formaldehyde and fed to growing sheep in a nitrogen balance study. An abomasal digesta collection study was also conducted on rumen and abomasum cannulated mature wethers. In these studies of cannulated animals, a small tube is inserted into the body cavity of the animal in order to sample and analyze the contents.

There was an increase in both fecal and urinary nitrogen excreted as the level of formaldehyde increased with a trend for increased protein retention by the animal. Crude protein digestion decreased but dry matter digestibility was not affected.

As the level of formaldehyde increased, there were linear increases in total crude protein, percent of dietary protein recovered, crude protein in the solid digesta, and nonammonia crude protein reaching the abomasum. Nonammonia crude protein reaching the abomasum was 60.9, 67.2, 92.4, and 110.4 grams per day for wethers fed the 0, 0.5, 1.0, and 1.5 percent formaldehyde-treated CBG, respectively. Total amino acids and each individual amino acid reaching the abomasum were increased by the treatment.

Are there any side-effects from using formaldehyde? Dr. Amos says no. When hay is baled out in the open, the lachrymal effect (causing tears) of formaldehyde on field workers would be greatly reduced. "We also have . . . found that it is necessary to expose the hay to formaldehyde for only about 8 hours. Also, the amount of water used with formaldehyde is almost nil—the moisture in the hay is very low. Otherwise we would have a problem with mold," he said.

Collaborating with Dr. Amos in the formaldehyde treatment studies were research chemists John J. Evans and Donald Burdick and physical science technician Tim Park, all at Russell Research Center.

Dr. Henry E. Amos is with the Field Crops Research Laboratory, Russell Research Center, P.O. Box 5677, Athens, GA 30604.—P.L.G.

Hormone Increases Sugarcane Yield

IT'S NOT LIKELY that Jack knew of the plant growth potential of the compound gibberellic acid (GA_3); his beanstalk's growth was more than likely caused by an overactive thyroid.

Many of the Nation's golfing fans first heard of the plant hormone during the 1977 U.S. Open golf tournament. Officials had it sprayed on the roughs to increase growth of the grasses to give the pros more of a challenge.

Plant physiologists working with sugarcane in Hawaii have found that gibberellic acid can add almost \$2 million in profits for the 17,000 acres treated this year.

The 17,000 figure is acreage in Hawaii that has undergone GA_3 treatment. Perhaps 50,000 acres of Hawaii's 225,000 acres of sugarcane has gibberellin potential. The \$2 million figure was based on a \$225 per ton sugar price. Recently, support prices were raised in Hawaii to nearly \$270 per ton. If all 50,000 acres are treated, with that support price, the GA_3 gain of 0.65 tons-sugar-per-acre will, of course, mean considerably more.

Gibberellic acid is obtained from an extract of a fungus that was first noticed about 20 years ago in Japan on rice that grew so fast and long that the infected plants fell over. Gibberellic acid is also used on grapes, first to thin out flower clusters and a second application that enlarges the remaining berries. The hormone is also used in the malting industry to stimulate fermentation of grains.

Hawaii's sugarcane is a 2-year crop. Half the crop is harvested each year. Sugarcane is a grass much like bamboo or corn with a stalk composed of joints; a new joint is produced every 10 days. During the long, warm days of summer, the internodes—stalks—between joints can grow from 9 to 10 inches. In the winter, however, during the cooler, shorter days, the internodes grow only about 3 inches. It's that "stress period"

that the hormone bridges so that the joints of the treated plants grow 9 to 10 inches as they do in summer periods. That growth adds nearly 7 tons of cane and results in $\frac{3}{4}$ ton of sugar.

Extremely small doses of GA_3 are applied to sugarcane. Two 1-ounce-per-acre applications of the hormone about 30 days apart is enough to break the stunting caused by cool short days. Costs per acre are \$32 for GA_3 and about \$6 for spraying by plane. The profit from GA_3 is realized in about 100 days.

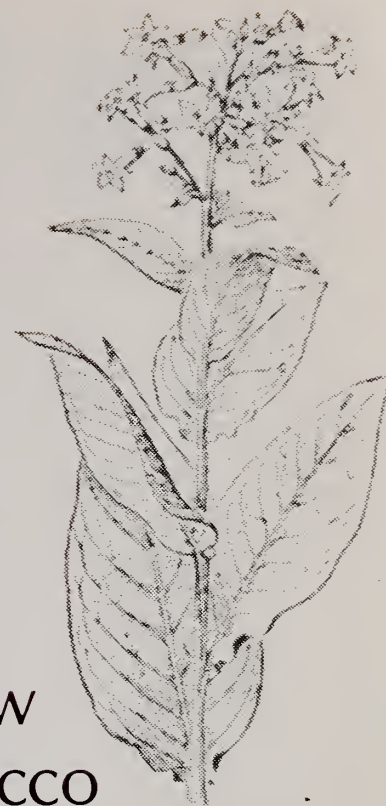
SEA plant physiologist Paul A. Moore is working in cooperation with the Hawaiian Sugar Planters Association, and has been researching GA_3 on sugarcane for some time, among other things.

"The low growth rate of sugarcane during the winter in Hawaii can be stimulated to increase yields by application of gibberellic acid. The amount of gain depends upon the cultivar and the environmental conditions at time of application. We have analyzed sugarcane cultivar differences in response to GA_3 and found that lowland cultivars generally grow more than do highland cultivars when treated with GA_3 . This information is being used by plantations to select fields and cultivars for treating with GA_3 ," said Dr. Moore.

Moore is continuing the research on improving aerial applications. Such small doses as 1 ounce per acre pose a problem of applying an equal amount of GA_3 to each of 30,000 stalks.

Chances are that gibberellic acid is not applicable to other cane-growing areas since no other area grows cane in winter. The hormone may have application at some future date in Florida if cane were to be grown there for periods longer than 1 year.

Dr. Moore's address is: Hawaiian Sugar Planters Association Experiment Station, P.O. Box 1057 Aiea, Honolulu, HI 96701—J.P.D.



Pale Yellow Tobacco

PALE YELLOW TOBACCOS offer growers of flue-cured tobacco an early maturing type that can be used to extend the harvest period when grown in conjunction with normal green varieties. Concomitant benefits include reduced barn space and fewer harvest hands which should make it easier to keep full-time employees.

SEA plant physiologist Ralph E. Williamson and SEA agronomist James F. Chaplin studied pale yellow tobaccos during two growing seasons. They found these tobaccos can be harvested 2 weeks earlier than their green counterparts, and through varying harvest schemes can produce good cured leaf with acceptable levels of sugar.

In addition to the economic benefits of extending the harvest period, the pale yellow tobacco if harvested and cured properly should produce tobacco equal in quality to the normal flue-cured cultivars.

Dr. Williamson and Dr. Chaplin conducted the research at the Tobacco Research Laboratory, Route 2, Box 16G, Oxford, NC 27565.—V.R.B.

Hog Cholera Eradicated .



Dr. Marion Dorset, circa 1905. It was Dr. Dorset who, in 1903, demonstrated that hog cholera is caused by an ultra-microscopic virus (PN-4156).

IN THE EARLY YEARS of this century, hog cholera “often swept through the countryside, causing devastating losses. During the fall months, looking across the prairies of the Middle West, one could often see smoke ascending from perhaps a half-dozen farms where pigs dead of cholera were being burned,” USDA veterinarian C. N. McBryde recalled later.

On January 31, 1978, Secretary Bob Bergland declared the United States hog cholera free in ceremonies in Washington, D.C. This was 99 years after USDA began hog cholera research and 17

years after the start of a Federal-State eradication campaign.

Whether hog cholera originated in America or Europe is not definitely established, but most experts believe it to be native to this country. Cholera was first reported in the United States in 1833 in southern Ohio. By 1893, 90 separate areas of infection were known to exist. Outbreaks in 1886, 1887, and 1896 each killed more than 13 percent of the Nation’s hogs; more than 10 percent died during the 1913 outbreak. The disease was still costing producers \$50 million a year in the early 1960’s.

... A Case History



Task-force members quarantine a farm infected with hog cholera during an outbreak of the disease, in 1970 in the Dismal Swamp region of Virginia and North Carolina (0970C890-1).

A key research discovery leading to control and eventual eradication of hog cholera was made in 1903. Marion Dorset of USDA's Bureau of Animal Industry (BAI) demonstrated that hog cholera is caused by an ultramicroscopic virus, and hogs recovered from the disease are immune for life.

Almost 20 years earlier, Department scientists thought they had identified a bacterium resembling the one responsible for typhoid fever as the cause of hog cholera. But when Dr. Dorset tested a serum from that bacterium during an 1897 outbreak in Iowa, injected hogs still died of cholera. He therefore questioned prevailing scientific opinion, and about 6 years later proved that hog cholera is a virus disease.

The first practical preventive measure, injection of anti-hog-cholera serum and then the virus, was successfully tested in 1907 by the BAI Field Station near Ames, site of many later advances

in hog cholera research. Dr. Dorset, Dr. McBryde, and W. B. Niles found that serum from the blood of immune hogs conferred immunity lasting only a few weeks to other hogs. But injection of the BAI hyperimmune serum plus injection of virus gave lifelong protection against hog cholera to most hogs.

A system of swine sanitation named for McLean County, Ill., where BAI developed it in 1927, became a valuable adjunct in immunization against cholera by this method. The system, developed primarily to prevent roundworm infestation of hogs, also reduced incidence of filth-borne intestinal diseases. Serious side effects were produced when hogs with even low-level intestinal infections were immunized against hog cholera.

Department scientists realized that a control method involving use of the live virus offered no hope for eradicating hog cholera. So they began work toward

a protective vaccine made with killed virus. Research of Drs. Dorset and McBryde, and C. G. Cole at Ames culminated in the development of the crystal violet killed vaccine in 1935. An initial problem of contaminants in the vaccine was overcome when F. W. Tilley patented a procedure 10 years later for preparing a consistently sterile crystal violet vaccine.

Scientists long sought reasons why this and later improved vaccines did not confer immunity to some hogs. The problem was partly solved in 1949 with the discovery of a variant of the hog cholera virus. Antiserum against both types of virus was needed for protection.

Researchers in Iowa meanwhile had learned much about the transmission and persistence of the hog cholera virus. They found that the virus is present in the circulating blood of the sick animal and also in the various secretions and

excretions. The virus remained active throughout the winter in carcasses of cholera-infected hogs buried in the fall, and unburied carcasses of infected pigs remained infectious for 11 weeks during cold weather.

Contrary to popular belief at one time, pigeons did not prove to be carriers of hog cholera virus, although transmission by crows and buzzards was not ruled out. Extensive experiments at Ames demonstrated conclusively that the house fly and stable fly are capable of transferring the cholera

virus from sick to well pigs. Prevalence of biting flies and incidence of hog cholera correlated closely during the years of the study.

After Dr. J. A. Baker, Cornell University veterinarian, developed a modified live-virus vaccine for hog cholera in 1951, producers faced a dilemma. The live-virus vaccine gave more effective protection but was a potential source of new infections. Killed-virus vaccines offered a chance for eradication of hog cholera but did not give as high a level of protection.

In 1963—2 years after eradication was mandated by law—Agricultural Research Service (ARS) regulatory officials prohibited interstate shipment of virulent virus or of feeder pigs and breeding stock vaccinated with this virus. Modified live vaccine and killed vaccines continued in use until banned in 1969. Animal disease regulatory activities were transferred to USDA's Animal and Plant Health Inspection Service in 1971.

The 1961 decision to eradicate hog cholera came during large-scale field

Swine sick with hog cholera—a sight all too common before development of an effective vaccine (32638-B).



Button ulcers in the large intestine, a common sign of hog cholera. Each infected hog was a virus factory, multiplying the chances that the disease would spread (BN-37551).



tests conducted by ARS in Florida, Iowa, and Georgia.

The ARS Hog Cholera Research Station at Live Oak, Fla., tested modified live-virus vaccines and anti-hog-cholera serum on about 60,000 swine on 1,500 Florida farms. ARS veterinary medical officer M. R. Zinober in 1959 reported that 92.2 percent of the pigs and 89 percent of the vaccinated herds were adequately protected.

In a 5-year Iowa farm study, ARS veterinary medical officer J. P. Torrey reported adequate protection for most of 67,558 pigs that received a single injection of killed hog cholera vaccine 2 weeks before weaning. Two vaccinations, 2 weeks after weaning and a month later, overcame the inability of some pigs to develop immunity. No cholera outbreaks took place on 60 farms cooperating in the study completed in 1963.

No cases of hog cholera were confirmed during a 3-year eradication test begun in 1961 in Lowndes County, Ga. Ninety-seven percent of the hogs in the county received two vaccinations during a 2-month period. ARS scientists said results of these experiments confirmed that killed-virus vaccines are safe and effective.

As late as the early 1960's, the procedure for diagnosing hog cholera was expensive and sometimes required several weeks to complete. Blood from the suspect animal was injected into one free of the disease, it was observed for clinical signs, and an attempt was made to recover hog cholera virus. The marked disadvantages of the test precluded its use in a nationwide eradication program.

In 1963 ARS veterinary medical researchers W. L. Mengeling, E. C. Pirtle, and J. P. Torrey reported a rapid, accurate diagnostic test for hog cholera

that takes less than a day. In the test developed at the National Animal Disease Center, Ames, Iowa, a culture containing tissue from a suspect hog is treated with fluorescent dye that is in combination with anti-hog-cholera serum. Infected cells retain the dye-serum and are readily distinguished from non-infected cells under a microscope.

Later research at NADC furnished additional tools for restricting transmission of hog cholera virus and contributed to successful eradication.

Dr. Torrey and W. C. Amtower found that sodium-o-phenylphenate, a material used for disinfecting hospitals,

HOG CHOLERA HISTORY . . .

was effective and safe for disinfecting farms, trucks, sale barns, and packing houses where hog cholera virus may be present.

Another study by Dr. J. K. Prather indicated that heating infected blood or serum to 69° C. and holding this temperature for 30 minutes destroys hog cholera virus—and therefore would destroy the virus in heat-processed meat. Department scientists had earlier found that the virus survives dry-salt or



Right: Bartholemew County, Ind., 1941: A veterinarian injects hog cholera virus and anti-serum. Simultaneous treatment helped fight hog cholera by causing production of antibodies (National Archives photo 145-AAA-8040).

...HOG CHOLERA HISTORY

brine curing of hams taken from cholera-infected hogs.

Hog cholera was the most devastating disease of swine in this country for more than a century. Containment and eventual eradication required research-based information on the cause and transmission of the disease as well as methods for diagnosis and prevention. And total eradication was achieved through close cooperation of scientists, Federal and State regulatory agencies, producers, and affected industrial groups.—*W.W.M.*

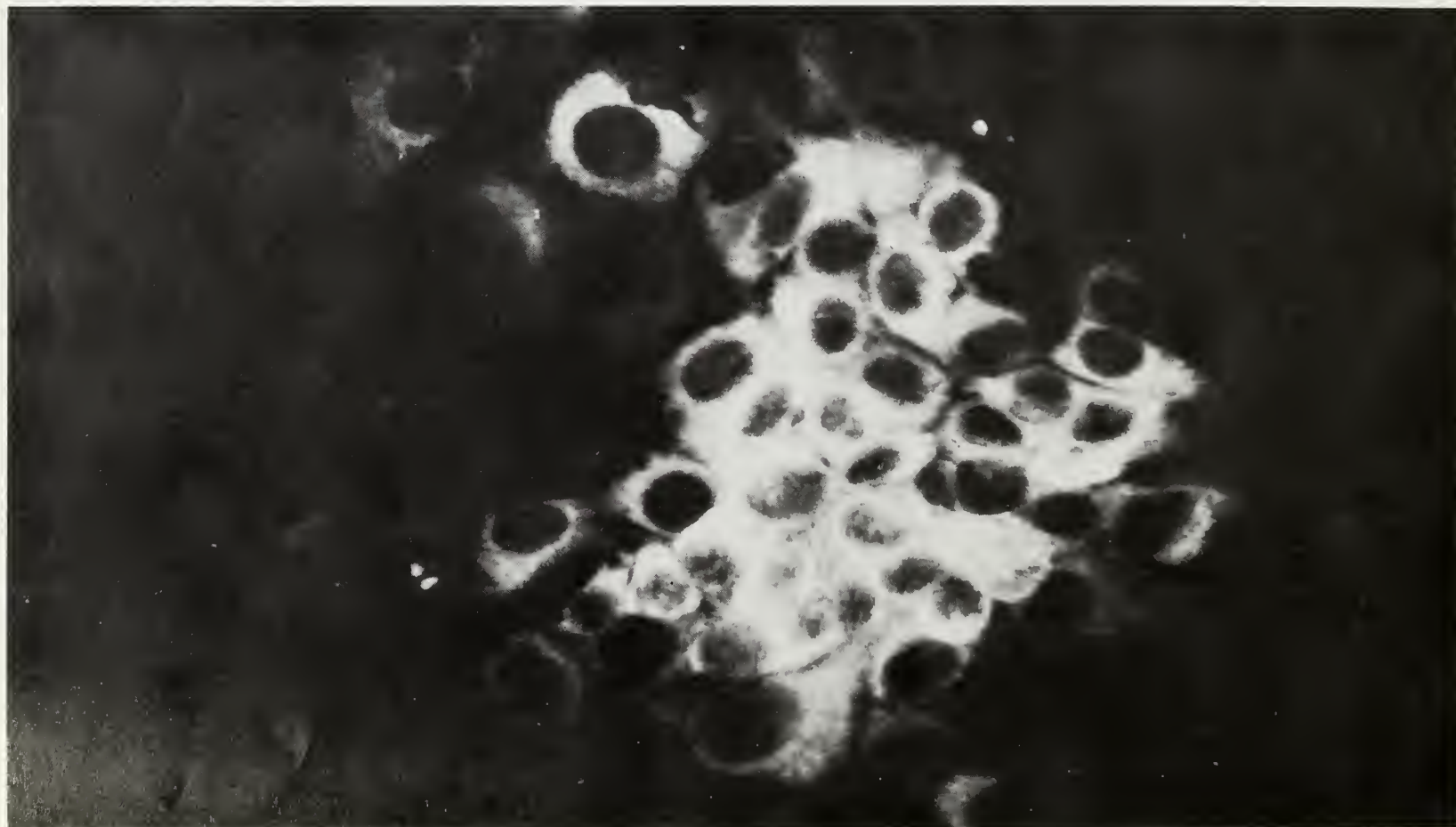
In 1963, a rapid test for hog cholera by immunofluorescence was developed by researchers at NADC as demonstrated in this photomicrograph. A "bright stained look" characterizes cells that have been taken from a suspect hog and which have been treated with fluorescent dye used in combination with anti-hog-cholera serum. Infected cells retain the dye-serum and are readily distinguished from noninfected cells (BN-20850).

Hog Cholera Research Calendar

- 1878 USDA begins hog cholera research.
- 1886 Hog cholera and swine plague shown to be different diseases.
- 1903 Hog cholera is caused by a virus, and survivors of the disease are immune for life.
- 1906 Anti-hog-cholera preventive serum developed.
- 1927 McLean County system of swine sanitation developed; was a valuable adjunct in successful immunization of swine against hog cholera.
- 1935 Crystal violet killed vaccine developed to prevent hog cholera.
- 1949 Variant of hog cholera virus discovered.
- 1963 Rapid laboratory test by immunofluorescence developed for diagnosing hog cholera.
- 1964 Heating to 69°C. and holding this temperature 30 minutes destroys hog cholera virus in blood or serum.
- 1964 Eradication experiment in Lowndes County, Georgia, confirms that killed-virus vaccines are safe and effective.
- 1964 Sodium-o-phenylphenate effective and safe for disinfecting farms, trucks, sale barns, and packing houses where hog cholera virus may be present.

Hog Cholera Eradication Calendar

- 1961 Congress authorizes National Hog Cholera Eradication Program.
- 1966 Half of Nation reaches "stamping out" phases- hogs destroyed with indemnities.
- 1969 Federal action outlaws interstate shipment of vaccines, vaccinated hogs.
- 1970 "Task Force" approach to eradication first used successfully.
- 1972 Serious outbreaks hit Midwest and Southeast; Secretary declares "National Emergency" because of hog cholera.
- 1975 Nation enjoys 14-month period with no hog cholera--longest ever.
- 1978 Nation declared "Hog Cholera Free."





Once the drum is covered and rotating, these peas will be frozen to -18°C . (0°F .) in 2 minutes. The drum will then be drained, and the peas spun dry for 15 seconds (0677X686-9).

Freeze Dried Vegetables

VEGETABLES FROZEN in a liquid freezant require 25 percent less energy than vegetables frozen in conventional air-blast freezers, an SEA study has found. Freezing times can be reduced from 25 to as few as 2 minutes.

"Our system works faster and more efficiently for the same reason hard-boiled eggs dipped in cold, running water cool faster than those placed in a refrigerator," says chemical engineer George H. Robertson at SEA's Western Regional Research Center.

The freezant consists of 15 percent table salt, 15 percent alcohol and 70 percent water at a temperature of -20°C . (-6.7°F). Selection of this combination is based on cost, flavor, safety, lowered freezing temperature and pourability.

With a commercial-sized operation, vegetables frozen in a blast of cold air require large equipment because of the time required for heat to leave the product. Freezing time is reduced by circulating air rapidly past the product, but this consumes excess energy. Also, circulating air dehydrates vegetables and

can result in losses up to 1 to 2 percent of the product's weight. Direct immersion in a liquid freezant is fast, requires much less energy, and doesn't dehydrate. Because it is fast, much smaller sized equipment than currently used would be required for commercial operations.

The new process, currently under development in Berkeley, involves dipping blanched carrots, sweet corn, snap beans, or peas in a 5 percent sugar solution for 1 minute followed by draining for 30 seconds. This step prevents pickup of freezant in the next step which could result in off-flavors.

The dipped vegetables are placed in a freezer drum, which acts much like a conventional front-loading clothes washer. The drum rotates and thoroughly agitates vegetables in the freezant.

Rotating at 50 revolutions per minute (rpm), the pilot-scale drum can freeze carrots and peas to approximately -18°C . (0°F .) in 2 minutes. Other vegetables require slightly longer time.

To remove excess freezant, the drum is drained and then spun at 200 rpm for 15 seconds. Blot drying vegetables with polyurethane foam blankets completes the process.

"This freezing technique could be scaled-up to handle production of a full-sized plant," says chemical engineer Daniel F. Farkas. "Currently, we are examining alternative freezing media and developing pilot-scale continuous freezing equipment."

"Freezing times for this direct immersion technique are very close to times for techniques using cryogenic and fluorinated hydrocarbon freezants. However, these freezants are expensive and as much as 2 pounds of fluorinated hydrocarbon per 100 pounds of product can be lost . . . much too expensive an operation for low-value foods such as vegetables," says Robertson.

Taste panel evaluations showed that mixed vegetables prepared by the SEA-developed process were equal to those prepared by conventional freezing techniques.

Dr. George H. Robertson is at SEA's Western Regional Research Center, 800 Buchanan Street, Berkeley, CA 94710.—D.H.S.

Dr. Robertson prepares a liquid immersion freezer for testing with mixed vegetables. Beneath the lid of the freezer is the heart of the process—the rotating drum in which the vegetables are frozen in an aqueous (water) medium of salt, water, and ethanol (0677X696-6).



Double Lambing with Polypays

DOUBLING PRODUCTION without a proportionate increase in overhead costs is the "impossible dream" of every business person. Only such a dream is no longer impossible for sheep producers as SEA-developed Polypay ewes promise to make twice-a-year lambing a viable reality.

The name "Polypay" means "multiple paychecks" and that is exactly what these ewes can mean to sheep producers for they are potentially capable of conceiving and raising twin lambs twice a year in addition to a wool crop. Good progress is being made toward this goal.

Today's market price for lamb is rising because demand is high while supply is low. U.S. producers currently market less than 3 pounds of lamb per person per year. Consequently, we import nearly \$20 million worth of lamb each year. Polypay ewes could help our producers better meet domestic needs, stabilize market prices and also increase their net profits.

Polypay ewes originated from crosses of Targhee x Dorset and Rambouillet x Finnsheep breeds which in turn were crossed to form the final, four-cross breed. The synthetic breed was developed under the leadership of SEA animal physiologist Clarence V. Hulet.

Polypays are a part of a plan to develop an intensive lamb production system. The need was for a breed of sheep possessing a relatively short gestation and postpartum interval (the interval between lambing and conception) as well as a long breeding season.

Polypays are well endowed with

each of these characteristics. From the Rambouillet and the Targhee breeding they obtain hardiness, herding instinct, size, and the long breeding season. Dorset breeding contributes carcass quality, milking ability, short gestation and, again, the long breeding season. Finnsheep breeding adds early puberty, short gestation, and postpartum fertility as well as high lambing rates.

Initially, hormone treatments were used to induce twice-a-year lambing. Prior to the Polypays, the best hormone-induced conception rate in lactating ewes within 6 weeks of lambing was 44 percent. Following hormone treatment after spring lambing, Polypay ewes have achieved a 56-percent lambing rate in the fall plus an 85-percent rate in the following spring with no additional hormone treatments.

Also, it appears possible to achieve twice-a-year lambing in Polypays without hormones. They can lamb in February and a considerable number will, and breed naturally in March, lamb again in August and breed quite successfully in September. Continued careful selection will be required to achieve a high level of success without hormones at the March breeding.

Furthermore, 85 to 95 percent of the Polypay ewes possess the ability to breed at the age of 6 to 7 months and give birth to one or more lambs at 12 to 13 months. This ability to breed at such an early age enhances the Polypays' potential for putting more lamb on the dinner table.

Dr. Clarence V. Hulet's address is U.S. Sheep Experiment Station, Dubois, ID 83423.—*L.C.Y.*

AGRISEARCH NOTES

New Webworm Monitor

THE ENVIRONMENT COULD be spared a lot of pesticide-spraying and growers could save time and money by using traps baited with an SEA-developed synthetic pheromone to monitor sod webworm populations in fields.

Sod webworms, which are moths in the adult stage, are serious grass pests that are difficult to treat with pesticides. They mate for 3 to 4 weeks in June and July, and the resulting larvae immediately burrow under the soil. The larvae eat the root crowns of grasses, and farmers never know what's happening until brown spots appear in fields.

To control this "invisible" enemy, farmers currently spray fields with pesticides on a seasonal schedule—usually several times a year. This often results in pesticides being sprayed in the environment when there are no webworms present.

SEA chemist Leslie M. McDonough, Yakima, Wash., and SEA entomologist James A. Kamm, Corvallis, Oreg., hope to eliminate unnecessary pesticide-spraying through the use of a synthetic sex attractant which they produced by determining the chemical structure of the natural pheromone extracted from female webworms.

By dispersing traps baited with the synthetic pheromones throughout fields, the SEA researchers can detect the presence of adult webworms and determine when to spray. Monitoring webworm populations permits selective pesticide applications.

In the future, Dr. McDonough and Dr. Kamm hope to use their synthetic pheromone as a direct webworm control tool. Pheromones would be sprayed directly on crops during the mating season. The non-toxic synthetic lure

confuses male moths to the point where they can't find a female to mate with. To do this, a better formulation of the synthetic pheromone will be needed.

Dr. Leslie M. McDonough's address is 3706 West Nob Hill Boulevard, Yakima, WA 98902; Dr. James A. Kamm is at Room 2048-B, Cordley Hall, Corvallis, OR 97331.—*L.C.Y.*

New Test for Lysine

THE SEARCH FOR higher protein quality in wheat has been speeded-up with the discovery of a rapid way to measure the amino acid lysine in wheat by using commercially available equipment.

Researchers at SEA's Western Wheat Quality Laboratory, Pullman, Wash., projected light in selected wavelengths onto a sample of wheat and then, from the amount of light that is reflected, found they can determine the sample's lysine content. Using this technique, breeders will at last be able to quickly and cheaply sort through thousands of experimental wheat varieties and single out those highest in lysine.

Wheat has excellent nutritional value, but current popular varieties are low in lysine, an essential amino acid that limits the human body's ability to utilize wheat's protein. For years, wheat researchers have been trying to develop strains of wheat with a high lysine content but they've been hampered because the present test for lysine content is slow and expensive.

With good accuracy, the new SEA test reduces the time required to determine a wheat sample's lysine content from several days to 1 minute and cuts costs from about \$20 per sample to about 15¢ per sample. The new test

could allow thousands more wheat selections to be tested each year for lysine.

SEA food technologist Gordon L. Rubenthaler and Washington State University biochemist Bernard L. Brunisma developed the new lysine test. The test uses a near infrared reflectance technique developed earlier by SEA electronics specialist Karl H. Norris of Beltsville, Md.

Mr. Rubenthaler is at the Western Wheat Quality Laboratory, Room 7, Wilson Hall, Washington State University, Pullman, WA 99164.—*L.C.Y.*

Pecan Winter Injury Studied

THE SEVERELY COLD winter of 1976-77 allowed an SEA scientist to observe and evaluate winter injury to pecan nursery trees.

According to Dr. George D. Madden, U.S. pecan Field Station, soil type and rootstocks affected the degree of winter injury the seedlings received.

Pecan varieties that were budded to Riverside rootstock had more damage than varieties budded to Apache rootstock. Winter injury to both Choctaw and Wichita varieties budded to Riverside rootstock was three times greater than damage to the same varieties budded to Apache rootstock.

Also, Choctaw and Wichita received less damage than other varieties budded to Apache rootstock.

In his observations, Dr. Madden noted that all varieties planted in deep sandy soil received more damage than those planted in shallow sand with a heavy subsoil a foot or two below.

The temperature in Brownwood dropped to 14° F. on November 14, 1976, and produced the first incidence

of cold injury to pecan trees in the area since 1951. Serious winter injury also occurred in New Mexico and Georgia.

Dr. George Madden's address is U.S. Pecan Field Station, P.O. Box 579, Brownwood, TX 76801.—*B.D.C.*

Cestocide Shows Promise

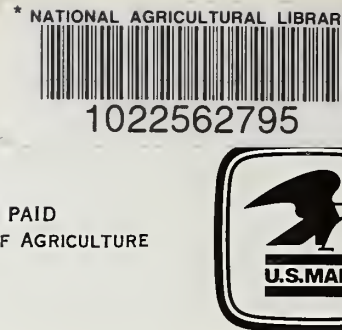
AN EXPERIMENTAL chemical, alben-dazole, now under study in cooperative research may one day relieve livestock producers from the economic losses they may now sustain due to tapeworms.

To evaluate the effectiveness of the compound, 60 commercial-grade calves naturally infected with tapeworm were used in a controlled experiment at the University of Georgia, Athens. Conducting the work were SEA microbiologist Honorico Ciordia, meat scientist H. C. McCampbell, and SEA animal physiologist John A. Stuedemann.

Calves were randomly divided into five groups of 12 each. Four groups were treated with albendazole at dose rates of 20, 10, 5, and 2.5 mg/kg of body weight. One group served as non-medicated controls.

Doses of 20 and 10 mg/kg proved 100 percent effective and doses of 5 and 2.5 mg/kg proved 97.8 percent effective in reducing tapeworms. None of the medicated cattle showed any signs of intoxication from the compound.

Dr. Honorico Ciordia's address is Cattle Parasites Research Laboratory, Experiment, GA 30212. Mr. H. C. McCampbell is with the University of Georgia, Athens, GA 30602; Dr. John A. Stuedemann is at the Southern Piedmont Research Center, Watkinsville, GA 30677.—*V.R.B.*



AGRISEARCH NOTES

Dwarf Bunt in Wheat

AN IMPORTED WHEAT germplasm material known simply as P.I. 178383 is one of the very best sources of dwarf bunt resistance currently available to wheat breeders, a recent SEA inheritance study suggests.

The presence of dwarf bunt spores in commercial lots of Western white wheat has severely limited wheat sales to countries which totally ban dwarf bunt, such as the People's Republic of China.

Dwarf bunt, a wheat fungus that, in the United States, occurs only in the Pacific Northwest, has no effect on humans but it does reduce wheat quality and yield. By incorporating sources of dwarf bunt resistance into their new varieties, wheat breeders hope to restore lost wheat export markets to the Pacific Northwest.

The inheritance studies were led by SEA geneticist Robert J. Metzger, Cordley Hall, Oregon State University, Corvallis, OR 97331, and were done in cooperation with Oregon State University.—L.C.Y.

Tetany Reduction Possible

SEA RESEARCHERS have found that split applications of fertilizers on pastures will maintain maximum forage growth but reduce the hazard of grass tetany.

Grass tetany, or hypomagnesemia, is

a magnesium deficiency occurring in cattle and sheep, sometimes causing a 5- to 10-percent death loss in herds located in temperate regions of the world. The frequency of grass tetany is accentuated by heavy nitrogen and potash fertilization of pastures.

A study led by SEA soil scientist Henry F. Mayland, Kimberly, Idaho, showed that splitting fertilizer applications reduces the concentration of nitrogen and potash in forage which in turn reduces the tetany hazard. Dr. Mayland also encourages ranchers to use a magnesium supplement along with some readily available energy source such as molasses to increase the intake and availability of magnesium to livestock.

Dr. Henry Mayland is with the Snake River Conservation Research Center, Route 1, Box 186, Kimberly, ID 83341.—L.C.Y.

Minor Nutrients Important

NITROGEN FERTILIZATION significantly increases the amount of zinc and copper in two major western rangeland grasses (green needlegrass and western wheatgrass), but livestock still require supplemental zinc and copper for proper nutrition.

Ranchers in the northern Great Plains have used nitrogen fertilization to increase forage production on their rangelands without knowing the effects of this fertilization on minor—but important—nutrients in grasses.

A study led by SEA soil scientist Ardell D. Halvorson, Sidney, Mont., showed that zinc and copper concen-

trations are below the minimum required by livestock for both green needlegrass and western wheatgrass and as the season progresses from April through October, these concentrations decrease.

Iron and manganese concentrations decrease from April to mid-June, then increase during the later part of the season. Nitrogen fertilization increases the zinc concentration in both grasses and the manganese and copper concentrations in green needlegrass.

The SEA study further showed that the time of forage harvest and the ratio of floral to vegetative tillers greatly influences the quantity of minor elements available for livestock consumption. Vegetative shoots displayed higher concentrations of these minor elements than floral shoots.

Dr. Ardell Halvorson is at the Northern Plains Soil and Water Research Center, P.O. Box 1109, Sidney, MT 59270.—L.C.Y.

When reporting research involving pesticides, this magazine does not imply that pesticide uses discussed have been registered. Registration is necessary before recommendation. Pesticides can be injurious to humans, domestic animals, desirable plants, and fish or other wildlife—if not handled or applied properly. Use all pesticides selectively and carefully.

